DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]
In this invention, it irradiates with a laser beam about a disc substrate and an optical disc from the side in which the information signal part and the light transmission layer were provided one by one on the disc substrate, and the light transmission layer was provided especially. Therefore, it applies to the optical disc in which record and/or playback of an information signal are performed, and is suitable.

[0002]
[Description of the Prior Art]
In recent years, it looks forward to large-scale-izing the storage capacity of a storage (data storage medium) further. For this reason, in the optical disc which is one of the storages which have spread most widely now, research for large-scale-izing storage capacity further is briskly done by carrying out densification of the storage density.
[0003]
For example, while carrying out short wavelength formation of the laser beam used for record/playback of an information signal as one method of realizing densification of an optical disc, By enlarging the numerical aperture NA (numerical aperture) of an object lens, the method of making a beam spot diameter small is proposed.
[0004]
For example, in the optical system of CD (Compact Disc). The semiconductor laser which outputs the wavelength of 780 nm, or an 830-nm laser beam, In the optical system of DVD (Digital Versatile Disc) in which NA has spread widely to having the object lens of 0.45 in recent years, it has the object lens of 0.6 for the semiconductor laser which outputs a laser

beam with a wavelength of 660 nm, and NA. By having such an optical system, one about 8 times the storage capacity of CD is realizable with DVD.

[0005]

However, if high NA-ization of such an object lens is advanced, the problem that the aberration of the light produced by inclination of a disk becomes large, and the permissible dose of the inclination to a disc face to the optic axis of an optical pickup (tilt) becomes small will arise. In order to solve this problem, making thin thickness of the substrate which makes a laser beam penetrate is proposed. For example, in CD, the 0.6-mm-thick substrate is used in DVD to a 1.2-mm-thick substrate being used.

[0006]

If it will take into consideration memorizing the image of HD (High Definition), etc. to an optical disc from now on, it will become insufficient [the capacity about DVD]. For this reason, the further short wavelength formation of the laser beam used for record/reproduction of an information signal, the further raise in NA of an object lens, and the further slimming down of the substrate are demanded.

[0007]

Then, the light transmission layer which has a thickness of 0.1 mm is formed on the information signal part formed on the substrate, An information signal part is irradiated with a laser beam with a wavelength of 405 nm via the object lens which has NA of 0.85 from this light transmission layer side, and the optical disc of the next generation which was made to perform record/playback of the information signal is proposed. Thus, in the optical disc of this next generation, since it has the composition which enters a laser beam from the light transmission layer side from the substrate side, the permissible dose of a tilt can be enough enlarged in spite of the high NA 0.85.

[0008]

When manufacturing the optical disc of this next generation, it is required rather than the conventional optical disc that curvature and eccentricity should be stopped still smaller. For this reason, in order to guarantee the mechanical characteristic of a final product when manufacturing a next-generation optical disc, a mechanical characteristic is measured in the earlier stage within a manufacturing process of the transparent substrate immediately after shaping, and it becomes important to feed back early.

[0009]

Conventionally, the mechanical characteristic measuring device using the optical stylus method as a device which measures inclination of a disk and eccentricity is known widely. It is necessary to have the pickup according to the format of the optical disc which measures a mechanical characteristic, i.e., a substrate and the thickness of a light transmission layer, and the size of the track pitch in this mechanical characteristic measuring device. This is for making

the light which made it condense by pickup follow a groove, when measuring the mechanical characteristic of an optical disc using the optical stylus method.

[0010]

The method of measuring the mechanical characteristic of a next-generation optical disc is proposed using the mechanical characteristic measuring device using this optical stylus method. In this method, a reflection film and a 0.1-mm-thick light transmission layer are formed at least on a disc substrate, and the mechanical characteristic of an optical disc is measured by the optical pickup mentioned above. Thus, the mechanical characteristic of an optical disc can be measured by the optical pickup of the format mentioned above by forming a reflection film and a 0.1-mm-thick light transmission layer at least on a disc substrate.

[0011]

However, since it cannot measure unless it is in the state which formed a 0.1-mm light transmission layer when it did in this way and the mechanical characteristic of the disc substrate was measured, it cannot measure in the state of the transparent substrate immediately after shaping. Therefore, manufacturing feedback will become slow and, as a result, will cause the fall of the productivity of an optical disc.

[0012]

Then, the pickup which can condense a laser beam to the groove formed in the disc substrate in the state where a 0.1-mm light transmission layer is not formed is designed, and the method of equipping a mechanical characteristic measuring device is proposed. However, designing such a pickup and preparing for a mechanical characteristic measuring device for the purpose only for measuring the mechanical characteristic of a transparent substrate, will cause the rise of the expense of a manufacturing facility.

[0013]

Then, the method of measuring the mechanical characteristic of a next-generation optical disc is proposed using the mechanical characteristic measuring device of the optical disc using the Opti Kars Thailand Lal method which has spread widely conventionally. This mechanical characteristic measuring device is used for the amount measurement of eccentricity of a disc substrate with a substrate thickness of 1.2 mm.

It has the semiconductor laser which outputs laser with a wavelength of 680 nm, and the pickup in which NA has an object lens of 0.55.

Since the substrate which has a thickness of about 1.1 mm is used in the next-generation optical disc mentioned above, the amount of field blur, inclination of a disk, etc. can be measured also with this conventional mechanical characteristic device by making a laser beam condense through a substrate.

[0014]

[Problem(s) to be Solved by the Invention]

However, in the format of the next-generation optical disc mentioned above, since a track pitch is set to 0.6 micrometer or less, the tracking error signal of sufficient size cannot be acquired in the optical system with which the conventional mechanical characteristic measuring device was equipped. That is, the amount of eccentricity cannot be measured in the conventional mechanical characteristic measuring device.

[0015]

Therefore, in an optical disc of 0.6 micrometer or less, the interval of the groove of a data area is in the state of the transparent substrate immediately after shaping, and SUBJECT of this invention has it in providing the disc substrate and optical disc which can measure the amount of eccentricity easily.

[0016]

[Means for Solving the Problem]

this invention person inquired wholeheartedly that above-mentioned SUBJECT which conventional technology has should be solved. The outline is explained below.

[0017]

According to this invention person's knowledge, it is because that a track pitch cannot measure the amount of eccentricity of a disc substrate of 0.6 micrometer or less cannot acquire a tracking error signal of size sufficient in a disc substrate of this format with the conventional mechanical characteristic measuring device.

[0018]

Then, this invention person examined wholeheartedly how a track pitch can acquire a tracking error signal of sufficient size with the conventional mechanical characteristic measuring device in a disc substrate of 0.6 micrometer or less that above-mentioned SUBJECT should be solved. As a result, an eccentric measurement region for measuring eccentricity is provided, and it came to recollect how only the inside of this eccentric field extends an interval of a groove.

[0019]

However, as a result of this invention person's examining this method further, this method found out having the following problems.

Generally, when a groove interval of a data area forms a thin groove of 0.6 micrometer or less, it must correspond to it, and wavelength of exposure laser at the time of mastering must also be shortened, for example, laser with a wavelength of 266 nm is used.

However, since groove width to a track pitch was too narrow when a track pitch is extended in the above-mentioned eccentric measurement region when laser of such short wavelength is used, sufficient push pull signal was not acquired and it found out having the problem that a signal wave form will also be distorted further.

[0020]

As a result of repeating the above examination, this invention person came to recollect equipping a disc substrate with a groove area in which a groove of 1 or 2 or more concentric circle shape was formed, and an eccentric measurement region contiguous to this groove area which consists of a planate mirror area.

[0021]

This invention is thought out based on the above examination.

[0022]

Therefore, in order to solve an aforementioned problem, application-concerned the 1st invention is a disc substrate having an eccentric measurement region where a groove area in which a groove of 1 or 2 or more concentric circle shape was formed, and a planate mirror area have been arranged by turns spatially.

[0023]

A disc substrate in which application-concerned the 2nd invention has an eccentric measurement region where a groove area in which 1 or two or more grooves were formed, and a planate mirror area have been arranged by turns spatially,

An information signal part formed in the 1 principal surface of a disc substrate,

A protective layer which protects an information signal part

It is an optical disc characterized by preparation ******.

[0024]

Since a disc substrate has an eccentric measurement region where a groove area in which a groove of 1 or 2 or more concentric circle shape was formed, and a mirror area on a flat surface have been arranged by turns spatially according to this invention as mentioned above,

A groove area can be made to follow an optical pickup for measuring the mechanical characteristic of an optical disc which has a groove of the same width as a groove area, and a land of the same width as a mirror area. Therefore, eccentricity of a disc substrate provided with a groove area and an eccentric measurement region can be measured using a mechanical characteristic measuring device for measuring the mechanical characteristic of an optical disc which has a groove of the same width as a groove area, and a land of the same width as a mirror area.

[0025]

[Embodiment of the Invention]

Hereafter, it explains, referring to Drawings for the embodiment of this invention. In the complete diagram of following embodiments, the same numerals are given to the portion which is the same or corresponds.

[0026]

An example of the composition of the optical disc by one embodiment of this invention is shown in drawing 1. An example of the composition of the substrate by one embodiment of this

invention is shown in drawing 2. An example of the composition of the sheet by one embodiment of this invention is shown in drawing 3.

[0027]

As shown in drawing 1, the optical disc by one embodiment of this invention comprises the following:

The substrate 1 of the annulus ring shape which has the center hall 1b mainly in the center section.

The flat-surface annulus ring-shaped light transmission layer 2 which has the breakthrough 2c in the center section.

By irradiating with a laser beam from the side in which the thin light transmission layer 2 was formed to the substrate 1, the optical disc by this one embodiment is constituted so that record/playback of an information signal may be performed. The light transmission layer 2 is formed by pasting together the sheet 4 shown in drawing 3 to the 1 near principal surface in which the information signal part 1c of the substrate 1 shown in drawing 1 was formed.

[0028]

As shown in drawing 1, near the center hall 1b of an optical disc, the clamp region 3 for equipping a spindle motor with an optical disc is set up. The diameter of inner circumference of this clamp region 3 is chosen from 22 mm - 24 mm, for example, is chosen as 23 mm. The peripheral diameter of the clamp region 3 is chosen from 32 mm - 34 mm, for example, is chosen as 33 mm.

[0029]

As shown in drawing 2, the substrate 1 comprises the disc substrate 1a by which the land and the groove were formed in the 1 principal surface, and the information signal part 1c formed in the 1 principal surface of this disc substrate 1a while the center hall 1b is formed in the center section. The data area and the eccentric measurement region are set to the field in which this land and groove were formed. In one embodiment of this invention, in the 1 principal surface of the disc substrate 1a, the direction near incident light is called a groove and the portion currently formed between this groove and groove is called a land.

[0030]

The thickness of the disc substrate 1a is chosen from 0.6 mm - 1.2 mm, for example, is chosen as 1.1 mm. The diameter (outer diameter) of the disc substrate 1a is 120 mm, for example, and the opening diameter (inner caliber) of the center hall 1b is 15 mm, for example. In a data area, data is recorded on either on a groove and a land, or both. We chose this time the method recorded on a groove. The distance (track pitch) between the grooves formed in the data area was set as 0.32 micrometer. Although chosen in consideration of the signal characteristic about the width of the groove formed in the data area, it was set as 0.22 micrometer (half breadth) this time.

[0031]
The disc substrate 1a comprises material which can penetrate the laser beam used for measurement of the mechanical characteristic of the disc substrate 1a at least, for example. As a material which constitutes this disc substrate 1a, resin of low water absorption property, such as polycarbonate (PC) and cycloolefin polymer (for example, ZEONEX (registered trademark)), is used, for example.
[0032]
A reflection film, the film which consists of an optical magnetic adjuster, the film which consists of phase change materials, or an organic dye film is provided, and the information signal part 1c is constituted. When the optical disc as a final product is an only for [playback] type (ROM (Read Only Memory)) optical disc, specifically the information signal part 1c, For example, the monolayer or the cascade screen which has at least a reflecting layer which consists of aluminum, an aluminum alloy, or an Ag alloy is provided and constituted. When the optical disc as a final product is a rewritable type optical disc, The information signal part 1c A TbFeCo system alloy, a TbFeCoSi system alloy, Or the monolayer or the cascade screen which has at least a film which consists of phase change materials, such as a film which consists of optical magnetic adjusters, such as a TbFeCoCr system alloy, a GeSbTe alloy, a GeInSbTe alloy or an AgInSbTe alloy, is provided and constituted. When the optical disc as a final product is a write once optical disk, the information signal part 1c comprises the monolayer or the cascade screen which has at least a film which consists of organic-coloring-matter materials, such as a film which consists of phase change materials, such as GeTe system material, or cyanine dye, and phthalocyanine dye.
[0033]
The eccentric measurement region is formed in the 1 near principal surface in which unevenness of the disc substrate 1a was formed. This eccentric measurement region is a field for measuring the amount of eccentricity of an optical disc, and a field for specifically measuring the amount of eccentricity of an optical disc using the mechanical characteristic measuring device of the conventional optical disc. In one embodiment of this invention, the conventional mechanical characteristic measuring device, It is a mechanical characteristic measuring device which specifically has a mechanical characteristic measuring device which measures the mechanical characteristic of an optical disc (for example, compact disk) with a substrate thickness of 1.2 mm, a semiconductor laser which outputs a laser beam with a wavelength of 680 nm, and the optical system which NA equipped with the object lens of 0.55.
[0034]
The top view of the eccentric measurement region formed in the 1 principal surface of the disc substrate 1a is shown in drawing 4. The groove area in which two or more grooves were formed, and the mirror area on a flat surface are arranged by turns spatially, and this eccentric

measurement region is constituted, as shown in drawing 4. The width of this eccentric measurement region is chosen more than the maximum of the amount of eccentricity generated in the manufacturing process of a replica substrate. Conventionally, since the maximum of the amount of eccentricity generated in the manufacturing process of a replica substrate is about 30 micrometers, the width of this eccentric measurement region is chosen as the range of 30 micrometers - 3 mm, for example, 100 micrometers.

[0035]

The groove of 1 or 2 or more concentric circle shape is formed in the groove area centering on the center hall 1b at concentric circle shape. Thus, the conventional mechanical characteristic measuring device can acquire the tracking error signal (push pull signal) of sufficient size by forming a groove in concentric circle shape. That is, the conventional mechanical characteristic measuring device can perform suitable tracking operation.

[0036]

Repeating interval d_2 of a groove area and a mirror area is chosen according to the optical system of a mechanical characteristic measuring device. When using the mechanical characteristic measuring device which has the optical system mentioned above, repeating interval d_2 of a groove area and a mirror area is chosen from the range of 0.7 micrometer - 2.5 micrometers, for example, is chosen as 1.6 micrometers. If repeating interval d_2 is 0.7 micrometers or more, in the mechanical characteristic measuring device which has the optical system mentioned above, the tracking error signal (push pull signal) of sufficient size can be acquired. That is, stable tracking operation can be performed. If repeating interval d_2 is 2.5 micrometers or less, in the mechanical characteristic measuring device which has the optical system mentioned above, a tracking error signal (push pull signal) without distortion can be acquired.

[0037]

The width of a groove area is chosen according to the optical system of the mechanical characteristic device which measures the mechanical characteristic of an optical disc. When measuring the mechanical characteristic of an optical disc using the conventional mechanical characteristic measuring device mentioned above, it is sufficient size, and as long as the distorted push pull signal which is not is acquired, what kind of width may be chosen. Usually, if it is the range of 0.2-0.8 of the interval between the above-mentioned groove areas, it is possible to fill the above-mentioned characteristic. if it carries out in minute of the interval between the above-mentioned groove areas about half [about] especially, the amplitude of a push pull signal will also serve as the maximum, and distortion will also be suppressed. If 1.6 micrometers of intervals between groove areas become, the width of a groove area will be chosen as 0.8 micrometer.

[0038]
The mirror area adjoined and formed in the groove area is a planate field in which the groove is not formed. The width of this mirror area is chosen according to the optical system of the mechanical characteristic device which measures the mechanical characteristic of an optical disc. When measuring the mechanical characteristic of an optical disc using the conventional mechanical characteristic measuring device mentioned above, it is sufficient size, and as long as the distorted push pull signal which is not is acquired, what kind of width may be chosen. Usually, if it is the range of 0.2-0.8 of the interval between the above-mentioned groove areas, it is possible to fill the above-mentioned characteristic. if it carries out in minute of the interval between the above-mentioned groove areas about half [about] especially, the amplitude of a push pull signal will also serve as the maximum, and distortion will also be suppressed. If 1.6 micrometers of intervals between groove areas become, the width of a mirror area will be chosen as 0.8 micrometer.
[0039]
It is not preferred for it to be spiral and to form a groove in an intermission. When this has a spiral groove and it forms in an intermission, in the knot, it is to confuse and stabilize a push pull signal and for tracking not to start.
[0040]
Although the interval of the groove in a groove area does not need to be chosen as the same interval as the interval (track pitch) of the groove in a data area, it is preferred that it is below the diffraction limit of the optical system in the conventional mechanical characteristic measuring device mentioned above at least. On the contrary, if the interval of the groove in a groove area is short, the problem that the time at the time of cutting will become long will arise. Interval d_1 of a groove is chosen from the range of 0.05 micrometer - 0.6 micrometer, for example, specifically, is chosen as 0.1 micrometer.
[0041]
In the optical system of the conventional mechanical characteristic measuring device mentioned above, a 0.6-micrometer track pitch is a diffraction limit mostly. Therefore, in the conventional mechanical characteristic measuring device, each groove of a groove area is not identified but two or more grooves which constitute a groove area are identified just like one groove.
[0042]
As shown in drawing 3, the sheet 4 used for formation of the light transmission layer 2 by this one embodiment comprises glue line 2b which consists of a pressure-sensitive binder (PSA) laminated on the whole surface of the light transmittance state sheet 2a and this light transmittance state sheet 2a. In the substrate 1, this sheet 4 has similarly the structure pierced in the shape of a flat-surface annulus ring, and the breakthrough 2c is formed in the center

section. the diameter (outer diameter) of the sheet 4 -- the outer diameter of the substrate 1 -- almost -- the same -- or it is chosen as less than it, for example, may be 120 mm. On the other hand, the path (inner hole diameter) of the breakthrough 2c shall be chosen from the range below more than the opening diameter of the center hall 1b, and the diameter of the most inner circumference of the clamp region 3 (for example, diameter of 23 mm), for example, shall be 23 mm. The thickness of the sheet 4 is 100 micrometers, for example.

[0043]

The light transmittance state sheet 2a in such a sheet 4 consists of thermoplastics with which it was satisfied of the optical property which can penetrate the laser beam used for record/reproduction at least, for example and which has a light transmittance state. Property values, such as heat-resistant dimensional stability, a coefficient of thermal expansion, or a rate of hygroscopic expansion, are chosen from the material near the disc substrate 1a, and, specifically, this thermoplastics is chosen, for example from polycarbonate (PC), methacrylic resin, such as polymethylmethacrylate (poly methyl methacrylate), etc. The thickness of the light transmittance state sheet 2a is chosen from the range of 60 micrometers - 100 micrometers, and is more suitably chosen from the range of 70-100 micrometers. In this one embodiment, consideration of that the light transmittance state sheet 2a is pasted together to the 1 principal surface of the substrate 1 via glue line 2b which consists of a pressure-sensitive binder (PSA) will choose the thickness of the light transmittance state sheet 2a as 70 micrometers, for example. The thickness of this light transmittance state sheet 2a is determined in consideration of the thickness considered as the wavelength of the laser beam used for record/reproduction of an information signal, and the request of the light transmission layer 2.

[0044]

PSA which constitutes glue line 2b is methacrylic resin etc., for example. Although the thickness of this glue line 2b is 30 micrometers, for example, the thickness of glue line 2b and the material used as a pressure-sensitive binder are determined in consideration of the wavelength of the thickness considered as the request of the light transmission layer 2, and the laser beam used for record/reproduction of an information signal.

[0045]

Drawing 5 is a sectional view showing the image at the time of playback of the optical disc by one embodiment of this invention. As shown in drawing 5, in the optical disc by one embodiment of this invention, record/playback of an information signal are performed by irradiating the information signal part 1c with a laser beam from the side in which the thin light transmission layer 2 was formed to the substrate 1.

[0046]

Drawing 6 is a sectional view showing the image at the time of mechanical characteristic

measurement of the optical disc by one embodiment of this invention. As shown in drawing 6, in the disc substrate by one embodiment of this invention, the mechanical characteristic of a disc substrate is measured by irradiating with a laser beam from the field of an opposite hand with the 1 near principal surface in which unevenness was formed.
[0047]
According to one embodiment of this invention, the following effects can be acquired.
The data area which has a groove interval in the range which are 0.2 micrometer - 0.6 micrometer, Since the disc substrate 1a is equipped with the eccentric measurement region which has two or more grooves, where this groove interval adjoined a data area, the same groove area, and this groove area and which consists of a planate mirror area, On the conventional mechanical characteristic measuring device and concrete target which measure the mechanical characteristic of an optical disc with a substrate thickness of 1.2 mm. The mechanical characteristic measuring device which has a semiconductor laser which outputs a laser beam with a wavelength of 680 nm, and the optical system which NA equipped with the object lens of 0.55 is used, The amount of eccentricity etc. of the optical disc in the narrow track pitch format which has a groove interval in the range which are 0.2 micrometer - 0.6 micrometer can be measured. Therefore, in the state of the disc substrate 1a where the light transmission layer 2 is not formed, since the amount of eccentricity can be measured, an optical disc can be manufactured by an efficient production body system.
[0048]
As mentioned above, although one embodiment of this invention was described concretely, this invention is not limited to one above-mentioned embodiment, and various kinds of modification based on the technical idea of this invention is possible for it.
[0049]
For example, the numerical value quoted in one above-mentioned embodiment is only an example to the last, and may use numerical values different if needed from this.
[0050]
Although the example from which the distance between the grooves formed in the eccentric measurement region and the distance between the grooves formed in the data area differ in one embodiment mentioned above was shown, You may make it the distance between the grooves formed in the eccentric measurement region and the distance between the grooves formed in the data area become the same.
[0051]
[Effect of the Invention]
Since a disc substrate has an eccentric measurement region where the groove area in which 1 or two or more grooves were formed, and the mirror area on a flat surface have been arranged by turns spatially according to this invention as explained above, A groove area can be made

to follow the optical pickup for measuring the mechanical characteristic of the optical disc which has a groove of the same width as a groove area, and a land of the same width as a mirror area. Therefore, the eccentricity of the disc substrate provided with the groove area and the eccentric measurement region can be measured using the mechanical characteristic measuring device for measuring the mechanical characteristic of the optical disc which has a groove of the same width as a groove area, and a land of the same width as a mirror area.

[Brief Description of the Drawings]

[Drawing 1]It is a sectional view showing the structure of the optical disc by one embodiment of this invention.

[Drawing 2]It is a sectional view showing the composition of the substrate by one embodiment of this invention.

[Drawing 3]It is a sectional view showing the composition of the sheet by one embodiment of this invention.

[Drawing 4]It is a top view of the eccentric measurement region with which the replica substrate by one embodiment of this invention was equipped.

[Drawing 5]It is a sectional view showing the image at the time of the data reproduction of the optical disc by one embodiment of this invention.

[Drawing 6]It is a sectional view showing the image at the time of mechanical characteristic measurement of the optical disc by one embodiment of this invention.

[Description of Notations]

1 [... An information signal part, 2 / ... A light transmission layer, 2a / ... A light transmittance state sheet, 2b / ... A glue line, 3 / ... A clamp region, 4 / ... Sheet] ... A substrate, 1a ... A disc substrate, 1b ... A center hall, 1c

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[Translation done.]